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ORIGIN AND CHARACTER OF THE SAHARA.

At the annual meeting of the Scottish Meteorological Society on July 12, Dr. John Murray read an interesting paper, a summary of which is given in the August Proceedings of the Royal Geographical Society. In his paper, Dr. Murray treated of the meteorological conditions of desert regions, with special reference to the Sahara, the northern border of which he had recently visited. He pointed out that the arid regions of the world are distributed in two bands, north and south of the equator. They are all inland drainage areas, or areas where the streams have no connection with the sea. They are also regions where evaporation is in excess of precipitation, for if the latter were in excess the water would rise till it could flow into the sea, as in the case of the great lake district of North America, and the area would no longer be one of inland drainage. The largest of the deserts, the Sahara, is about three and a half million square miles in area, and the area of all the deserts of the world together is about 11,500,000 square miles. That is to say, over one-fifth of the land of the world has no outlet for drainage to the sea, and in all that area evaporation is greater than precipitation. These areas correspond very closely with the regions of the world where the rainfall is less than ten inches annually. In no place in the world can there be got such enormous changes of temperature as in the deserts. In the Sahara the temperature sometimes falls from 100° during the day to the freezing point during the night. This arises from the great dryness of the atmosphere, and from the radiation that takes

place from the burning soil after the sun has set. These inland drainage areas correspond very much in their barometric phenomena. In all desert regions during summer all winds blow in to them. In winter the reverse takes place, the winds flow out of them; and that holds good both for the northern and the southern hemispheres. This leads to the low rainfall, for the great majority of these regions are more or less bounded by high hills. The winds come into the deserts over these hills, and the vapor is precipitated from the atmosphere by the hills, with the result that when the winds reach the interior regions there is nothing left to be deposited. If there are not hills all round any desert area, then, as in the case of Northern Asia, the winds pass from a colder to a warmer climate, and as they get to warmer regions they are able to contain more vapor, and none is precipitated.

Dr. Murray then proceeded to give an account of his own views and impressions as to the Sahara. During the "Challenger" expedition he and his companions had found in the bed of the Atlantic for a long distance west of the African coast opposite the Sahara, and in the bed of the Indian Ocean to the south of Australia, small grains of red quartz sand; and they had found scarcely a trace of such in the sea-bed in any other part of the world. He suspected this quartz sand had been blown out from the Sahara in the one case, and from the Australian desert in the other. On his journey southward through Algeria, he found the country as far as Tougourt converted into a garden by means of artesian wells. At Tougourt the real sandy part of the desert began, and he made excursions into it, with that town as his headquarters. He exhibited to the meeting a specimen of the sand, of a light yellowish-brown color, and exceedingly fine in the grains. There were, he said, a good many clay particles in it, and the quartz particles, which were also numerous, were identical with those they had got in the bottom of the Atlantic. There was no doubt that the winds from the desert carried the sand a long way out to sea.

He had also examined the region geologically, and found that the formation of the rocks was entirely that of fresh water, and of quaternary date. The great majority of geographers and geologists have expressed the belief that the whole of the Sahara is an old sea-bed, but in his opinion, it has never as a whole been covered by the sea since Cretaceous or Devonian times; and no part of it has been covered by the ocean since Tertiary times. The whole question about the discovery of shells seems to rest upon one common species being found very rarely in one region of the desert. Owing to recent researches, the opinion as to the Sahara being an old sea bottom is very likely to disappear from our textbooks. He considers that the features of the region have been produced by atmospheric conditions. The sand is the product of the disintegration of the rocks *in situ*. The existing rock is not far below the surface, and by digging down to it, the hard sandy particles are found embedded in the stone. The sun shone on the rocks, and they expanded. The sudden cooling at night broke them up, the wind carried away the smaller particles, and so continually the rocks are being disintegrated by means of changes other than water, although water perhaps in times past played a greater rôle there than it does now. There is a range of hills in the desert, seven thousand feet high, and for three months in the year their summits are covered with snow. Descending the hills are old river-courses, some of great length. Much of the region, he considers, has once been a large fresh-water lake. Speaking of the commercial aspect of the Sahara, he said it was difficult to go there without becoming enthusiastic about it. There seems to be no limit to the amount of water that is to be got by sinking artesian wells. The cultivation of palms is extending to an enormous extent, and the French expect to carry on their railway to Tougourt, at present nearly a week's journey from Algeria, in the next few years.

BULLETIN No. 7, July, 1890, just received from the Virginia Agricultural Experiment Station, treats of tests with varieties of strawberries made the present season, giving full discussion, with critical descriptive notes of forty-nine varieties; also full tabular statements showing yields, earliness, quality, etc.